Chukchi Sea Play 10: Herald Arch-Thrust Zone

Geological Assessment

GRASP UAI: AAAAA DAK
Play Area: 3,130 square miles
Play Water Depth Range: 55-180 feet
Play Depth Range: 1,000-17,000 feet
Play Exploration Chance: 0.0144

Play 10, the "Herald Arch-Thrust Zone" play, is a subordinate play in the Chukchi Sea OCS Planning Area, with negligible technically recoverable petroleum resources.

Table 1 summarizes the volumetric input data developed for the *GRASP* computer model of Chukchi Sea play 10. Table 2 reports the risk model used for play 10. The location of play 10 is shown in figure 1.

This play involves highly-deformed Cretaceous and older (i.e., Lower Brookian, Ellesmerian) rocks that comprise acoustic basement beneath Herald thrust zone and Herald arch north of the limit for Tertiary strata in Hope basin. Highly deformed and seismically featureless pre-Brookian rocks rise to the seafloor beneath the Herald arch. Although fragments of axial areas of synclines are visible in some seismic profiles in Herald thrust zone, no traps can be reliably mapped. However, we speculate that traps in unseen anticlinal closures between synclines are present, but generally small in size consistent with the small fold wavelengths suggested by the synclines observed in seismic data. High levels of thermal maturity (1.76 percent vitrinite reflectance in Jurassic argillite cored at the seafloor south of Herald fault suggest that any pooled hydrocarbons will most likely be gas. This play was apparently tested at Eagle Creek and Akulik wells onshore, both of which recovered minor quantities of gas in drill stem tests from structurally complex Nanushuk or Torok Formation sandstones.

Because of the difficulties in seismic identification of prospects in play 10, coupled with high geological risks related to reservoir quality and trap integrity, play 10 was assessed with negligible technically recoverable petroleum resources.

GRASP Play Data Form (Minerals Management Service-Alaska Regional Office)

Basin: Chukchi Sea Planning Area
Play Number: 10 (Not Assessed)
Play UAI Number: AAAAA DAK

Assessor: K.W. Sherwood
Play Name: Herald Arch - Thrust Zone (Not Assessed)

Date: January 2005

Play Area: mi^2 (million acres) 3,130 (2.003)
Reservoir Thermal Maturity: % Ro 1.00 - 4.30

Play Depth Range: feet 1,000 - 17,000 (mean = 4,000)
Expected Oil Gravity: ^{o} API 60 (No Free Oil)
Play Water Depth Range: feet 55 - 180 (mean = 165)

POOLS Module (Volumes of Pools, Acre-Feet)

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Prospect Area (acres)-Model Input*	Insufficient Data for Statistical Fit												
Prospect Area (acres)-Model Output**	508	1368	1627	2174	3000	3362/1702	4140	4921	5533	6581	8000	9112	22447
Fill Fraction (Fraction of Area Filled)	0.12	0.19	0.20	0.22	0.25	0.25/0.04	0.28	0.30	0.31	0.33	0.35	0.37	0.50
Productive Area of Pool (acres)***	131	326	388	535	763	855/455	1054	1270	1437	1707	2050	2300	4080
Pay Thickness (feet)	15	25	34	41	50	52/16	61	68	73	81	92	100	140

* model fit to prospect area data in *BESTFIT*
** output from *@RISK* after aggregation with fill fraction
*** from *@RISK* aggregation of probability distributions for prospect area and fill fraction

MPRO Module (Numbers of Pools)

Input Play Level Chance	0.36	Prospect Level Chance	0.04	Exploration Chance	0.0144
Output Play Level Chance*	0.1203				

*From "0 Pools" Probability Reported in MPRO Module

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
	0.6	Closure Presence (poor mapping reliability)	0.8
	0.6	Timing (traps [~65 Ma] post-date migration [~100 Ma])	
		Chance Porosity > 10%	0.05

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	2	3	4	5.5	8	11.03/8.66	13	16	19	24	30	36	100
Numbers of Pools in Play						0.16/0.49			1	1	2	2	11

Zero Pools at F12.03

Minimum Number of Pools	1 (F10)	Mean Number of Pools	0.16	Maximum Number of Pools	11

Play 10 not assessed (assigned negligible resources) because mean number of pools < 1.0 (B. Dickerson Rule)

POOLS/PSRK/PSUM Modules (Play Resources)

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	No Free Oil												
Gas Recovery Factor (Mcfg/acre-foot)	55	238	272	335	423	459/184	538	621	689	803	930	1050	1862
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	No Free Oil												
Condensate Yield ((bbl/Mmcfg)	13	18	19	22	25	25/5	28	30	31	33	36	38	50

Pool Size Distribution Statistics from *POOLS* (1,000 BOE): μ (mu)= Not Run σ^2 (sigma squared)= Not Run Random Number Generator Seed= 941824

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	1
Probability Any Pool is 100% Gas	1		

Table 1. Input data for Chukchi Sea play 10, 2006 assessment (play assigned negligible resources and was not quantified with computer runs because it offers less than 1 potential pool).

Risk Analysis Form - 2006 National Assessment

Assessment Province:	Chukchi Sea OCS Planning Area	**Play Number, Name:**	10. Herald Arch - Thrust Zone
Assessor(s):	K.W. Sherwood	**Play UAI:**	AAAAA DAK
Date:	1-Jan-05		

For each component, a *quantitative* probability of success (i.e., between zero and one, where zero indicates no confidence and one indicates absolute certainty) based on consideration of the *qualitative* assessment of **ALL** elements within the component was assigned. This is the assessment of the probability that the minimum geologic parameter assumptions have been met or exceeded.

			Play Chance Factors	Averge Conditional Prospect Chance[1]
1.	**Hydrocarbon Fill component** (1a * 1b * 1c)	**1**	***1.0000***	***1.0000***
	a. Presence of a Quality, Effective, Mature Source Rock			
	Probability of efficient source rock in terms of the existence of sufficient volume of mature source rock of adequate quality located in the drainage area of the reservoirs.	1a	1.00	1.00
	b. Effective Expulsion and Migration			
	Probability of effective expulsion and migration of hydrocarbons from the source rock to the reservoirs.	1b	1.00	1.00
	c. Preservation			
	Probability of effective retention of hydrocarbons in the prospects after accumulation.	1c	1.00	1.00
2.	**Reservoir component** (2a * 2b)	**2**	***1.0000***	***0.0500***
	a. Presence of reservoir facies			
	Probability of presence of reservoir facies with a minimum net thickness and net/gross ratio (as specified in the resource assessment).	2a	1.00	1.00
	b. Reservoir quality			
	Probability of effectiveness of the reservoir, with respect to minimum effective porosity, and permeability (as specified in the resource assessment).	2b	1.00	0.05
3.	**Trap component** (3a * 3b)	**3**	***0.3600***	***0.8000***
	a. Presence of trap			
	Probability of presence of the trap with a minimum rock volume (as specified in the resource assessment).	3a	0.60	0.80
	b. Effective seal mechanism			
	Probability of effective seal mechanism for the trap.	3b	0.60	1.00
	Overall Play Chance (Marginal Probability of hydrocarbons, MPhc)		***0.3600***	
	(1 * 2 * 3) *Product of All Subjective Play Chance Factors*			
	Average Conditional Prospect Chance[1]			***0.0400***
	(1 * 2 * 3) *Product of All Subjective Conditional Prospect Chance Factors*			
	[1] Assumes that the Play exists (where all play chance factors = 1.0)			
	Must be consistent with play chance and prospect distribution -- See discussion on Page 3 of Guide			
	Exploration Chance		***0.0144***	
	(Product of Overall Play Chance and Average Conditional Prospect Chance)			

Comments: *See guidance document for explanation of the Risk Analysis Form*

2b: Chance That Porosity >10%, Based on Regional Model for Porosity vs Reservoir Thermal Maturity

Play 10 Not Assessed--mean number of pools <1.0 (B. Dickerson Rule)

Table 2. Risk model for Chukchi Sea play 10, 2006 assessment.

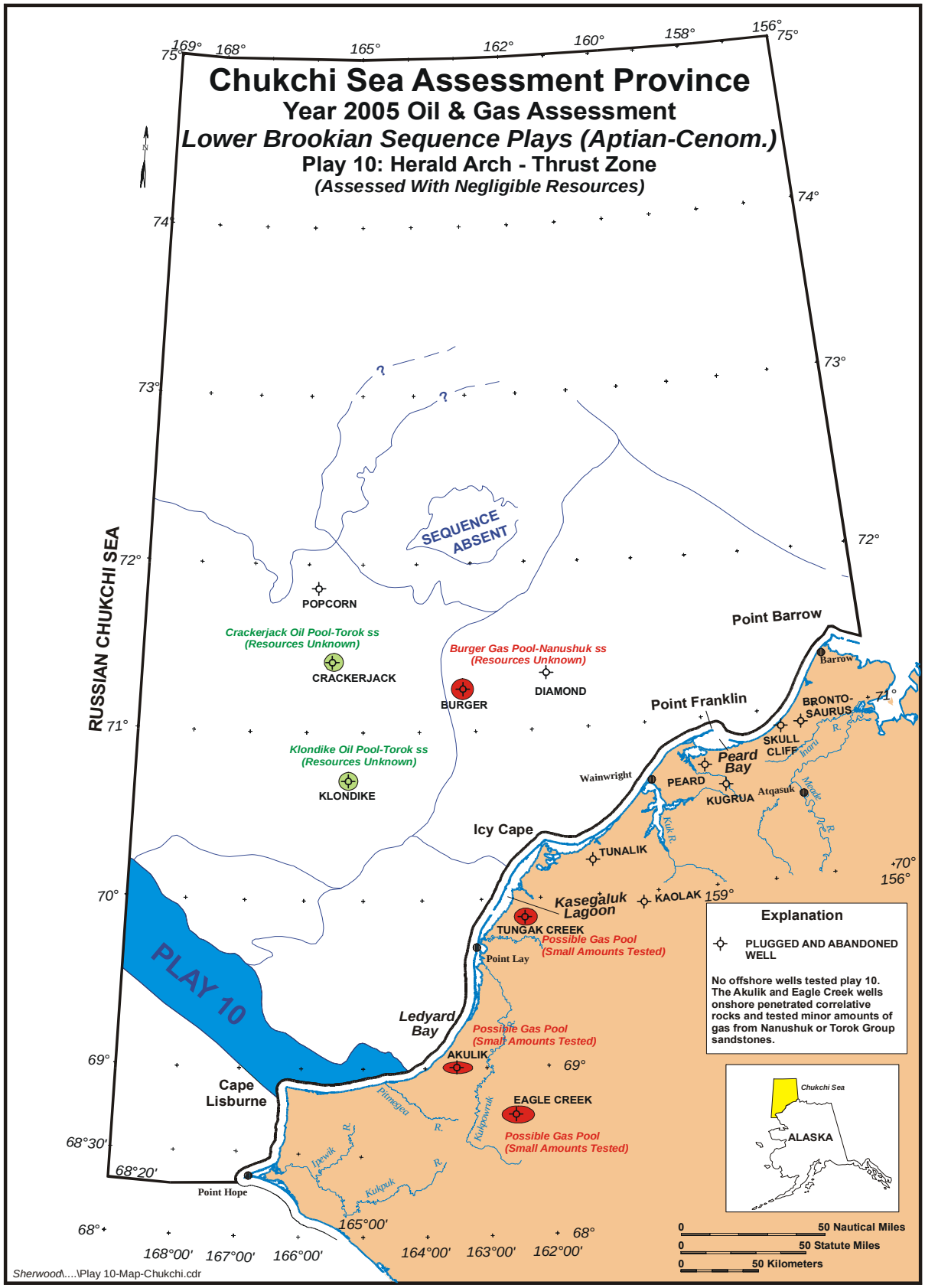

Figure 1. Map location of Chukchi Sea play 10, 2006 assessment.